



Catalytic Extraction Processing



Developer: Molten Metals Technology, Inc.

Contract Number: DE-AC21-93MC30171

Crosscutting Area: N/A

**Mixed Waste
FOCUS AREA**

Problem:

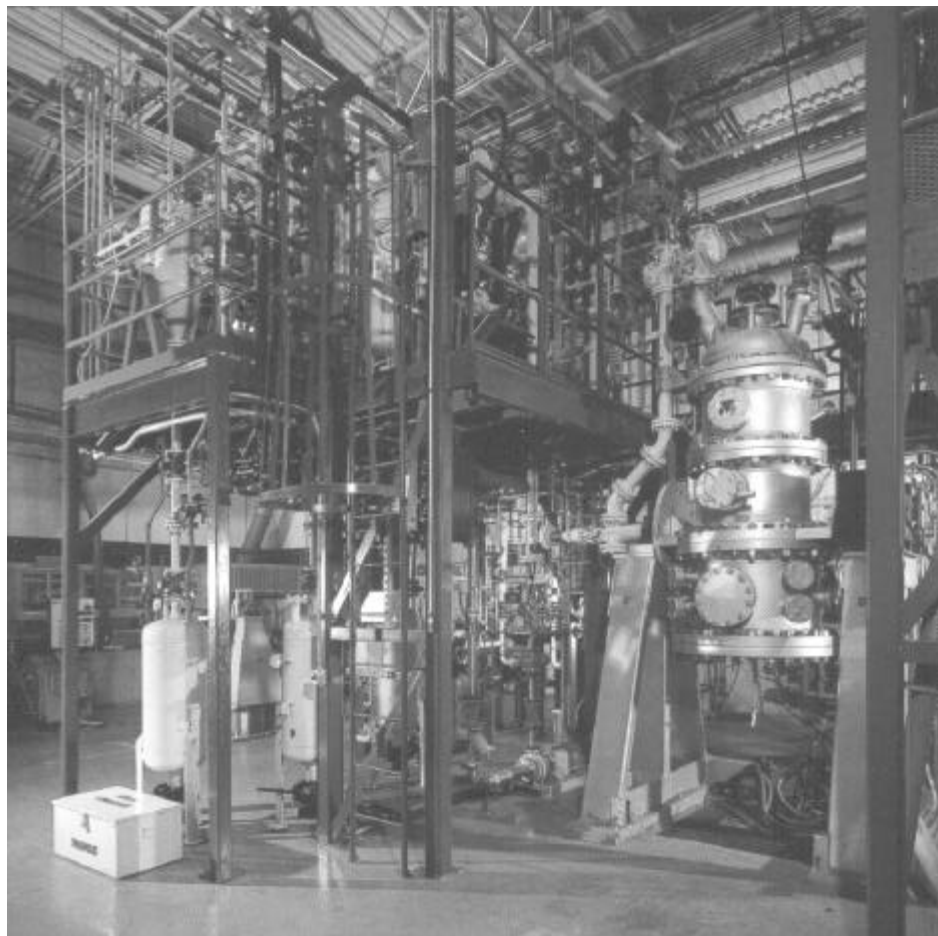
The Department of Energy (DOE) is faced with the task of meeting decontamination and decommissioning obligations at numerous facilities. Due to the tremendous volume of metals requiring decontamination and/or disposal, existing technologies are not adequate for meeting this goal with current or anticipated resources.

Solution:

The objective is the successful demonstration of an innovative technology, Catalytic Extraction Processing (CEP), to decontaminate radioactively-contaminated scrap metal. CEP is a patented technology for recycling hazardous and non-hazardous wastes.

Benefits:

- ▶ Robust integrated process accepts wide range of waste feed with little pretreatment
- ▶ Hazardous wastes converted to potentially valuable resources
- ▶ Minimal secondary waste generation
- ▶ Reduced processing costs for radioactive metallic and mixed wastes



- ▶ Reduced waste quantities and disposition costs

Technology:

CEP has been demonstrated on a variety of waste materials at Molten Metal Technology's Recycling Research and Development Facility in Fall River, Mass. CEP uses a molten metal bath to convert wastes to useful raw materials. Wastes are

injected into the molten metal bath, where the catalytic properties of the molten metal dissolve molecular bonds and reduce compounds to single elements. The elements can then be used as building blocks to form commodity gases, ceramics, and metals for disposal, recycle, or sale to established markets. CEP completely destroys hazardous compounds, exceeding regulatory standards for emissions and



residuals. The technology is targeted toward government, chemical, petrochemical waste generators, and central waste processors.

The core of CEP is a sealed molten metal bath, which operates at temperatures near 2,000°K. Upon introduction to the bath, the catalytic effect of the metal, selective reactants, and appropriate reaction engineering cause waste materials fed into the system to dissociate into their constituent elements and be incorporated into the molten metal. Addition of reactants enables elemental reformation and recycling of new products. The partitioning control and recyclable product production afforded by such reactant addition is a distinguishing feature of CEP technology. The resulting products can be recovered from the vessel in either the gaseous, metallic, or vitreous phase and are chemically identical to existing commodity chemicals, metals, and gases.

The CEP reactor is designed for continuous operation and is comprised of process components currently used widely by the metallurgical and chemical communities. CEP has been demonstrated successfully on many materials ranging from simple compounds (like paraffins, alcohols, and water) to complex material containing toxic metals, halogens, cyanides, PCBs, and polyaromatic hydrocarbons. Based on these tests, high-level feed destruction and high-value product syntheses have been proven experimentally.

This development project was to establish the commercial capability of the CEP to treat radioactively contaminated scrap metal from the DOE inventory. The objectives were to evaluate and demonstrate the

technical and economic capability of the CEP to: permit reuse or recycling of currently contaminated scrap metal, concentrate and stabilize radionuclides in a vitreous phase, minimize secondary waste, reduce waste volume, convert hazardous organics to industrial gases, and recover volatile heavy metals in the offgas treatment system.

Project Conclusion:

This project was concluded in March 1997. In this very successful program, Molten Metal Technology, Inc. demonstrated a robust, one step process that is relatively insensitive to wide variations in waste composition and is applicable to a broad spectrum of DOE wastes.

The Catalytic Processing Unit design was validated through experimentation. This effort substantially increased waste feed size, ceramic life expectancy, and knowledge of the partitioning of surrogate radionuclides. Two commercial facilities have been commissioned and have subsequently begun to process mixed low level wastes.

Depending on the type of feed, the average mixed low level feed rate is projected to be about 3,000 pounds per hour. According to the Integrated Thermal Treatment System Study (ITTS) sponsored by DOE/INEL in February, 1996, the CEP process was determined to have the lowest processing costs and disposal costs for each of the 19 thermal treatment systems studied. This cost was estimated at \$8.98 per pound. The closest competitor was Joule-Heated Vitrification at \$9.27 per pound. Another plus for this technology is that the Environmental Protection Agency has designated

this as a non-incineration process which makes permitting easier.

Contacts:

Molten Metal Technology, through its Research and Development Division, is engaged in innovative product improvement and process development for solutions to environmental and resource management needs. For information regarding this project, the contractor contact is:

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DOE's Federal Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

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